The International Geophysical Year

SCIENTISTS OF FORTY-SIX NATIONS STUDY THE LAND, SEA, AND AIR AROUND US

By

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We live on the surface of a large roughened ball of rock whirling through space around the kindly sun which furnishes us heat and light. Our every activity is carried out at the bottom of an ocean of air which supplies the oxygen we need to slowly burn the food we eat to give body heat and muscular energy. The scientific study of the motions, heat, light, and electrical properties of our earth, its continents, oceans, and surrounding atmosphere is the science of geophysics.

The scientist in a laboratory may study the laws of Nature under controlled conditions. The earth is too big to bring into a laboratory, and man as yet has little control over storms and earthquakes. The earth scientist can only observe the experiments which Nature makes, and he himself can see only what happens at one place at any one time.

From July, 1957, through December, 1958, some 5000 earth scientists from 46 countries will make a cooperative study of the nature of our earth and its atmosphere. In this International Geophysical Year, or IGY, the scientists will study the atmosphere and oceans from the equator to the poles and from ocean deeps to altitudes of hundreds of miles above the surface. They will measure the puzzling "electric rain" of the cosmic rays that bombard our atmosphere from space and the magnetic storms that hinder radio and telegraph communication.

In this great "symphony of science" the scientists will work as a well-conducted orchestra in harmony. Frequent observations will be made by all participants in each month of IGY on three or four days, called Regular World Days, picked for their coincidence with special phases of the moon. Every quarter during a ten-day World Meteorological Interval, the weather men will redouble their efforts. Whenever the sun shows unusual activity, or the northern aurora lights tower high, or magnetic storms occur, special alerts will be given so that observations may be made over all the earth at the same time.

The International Geophysical Year is the third in a series of International Years, the first being the First International Polar Year of 1882-83. That year contributed much to our knowledge of the "northern lights", the magnificent aurora borealis, that throws across the sky not only an impressive spectacle but also an electrical mirror

that interferes with radio reception. From bases set up in the Arctic, new information about Arctic weather and the earth's magnetism were systematically obtained.

The Second International Polar Year, half a century later in 1932-33, brought new knowledge of radio communication and the development of methods of bouncing pulses of radio waves from the ionosphere, that atmospheric layer from 50 to more than 200 miles above the earth in which ultraviolet light from the sun creates a large number of electrically charged molecules. These techniques were later applied in the development of radar.

After a lapse of only 25 years, interest in the earth sciences had been so great that learned societies around the world, working through their International Council of Scientific Unions, set in motion plans for the 1957-58 International Geophysical Year. Each country plans and carries out its own program under guidance of an international committee. An American, Dr. Lloyd V. Berkner, is president of ICSU and vice-chairman of its special committee on IGY. The National Academy of Sciences has the responsibility for realizing the United States program, using Federal funds obtained through the National Science Foundation. A U. S. National Committee has been established by the Academy with Dr. Joseph Kaplan as its chairman. The Department of Defense, with men and materials, ships, trucks, and planes from each of its three services, ~~are~~ is supporting the scientific teams, especially in remote and relatively inaccessible regions.

President Eisenhower has heralded the IGY as "a striking example of the opportunities which exist for cooperative action among the peoples of the world". The U.S.S.R. and at least four other Iron Curtain countries will take part.

The IGY will focus a major effort on the polar regions, especially Antarctica, with its 16,000 miles of little-known coastline. ~~Twelve~~ Eleven nations -- Argentina, Australia, Chile, France, Great Britain, Japan, New Zealand, Norway, ~~Spain,~~ Union of South Africa, the U.S.S.R., and the United States -- have plans for some 37 stations on Antarctica or its offshore islands. Several nations expect to send expeditions across the cold interior, making scientific observations on the way.

The United States plans six Antarctic observatories, the most remote being at or near the South Pole itself. Already Operation "Deepfreeze I" has accomplished much of the preparatory work. In October, 1956, Operation Deepfreeze II will begin, with reinforcement of the small parties who remained during the winter and the delivery of building materials, food, instruments, and other supplies. Some seventy IGY scientists will proceed to their stations, for the beginning of IGY in July, 1957, is in the middle of the Antarctic winter.

The stations in Antarctica will make daily weather observations both at the surface and to 100,000 feet by means of balloons. The balloons carry radio transmitters to send back reports on temperature,

pressure, moisture and wind. Standard magnetic observatories to measure field strength, dip and inclination, will be established at four of the American bases. Gravity measurements will be made on over-snow journeys and airplane flights. Balloon and rocket flights will yield information on cosmic rays which spray the earth constantly, with occasional power bursts far greater than those generated by the biggest man-made atomic accelerators. Holes will be drilled through the Ross Shelf ice and through inland ice to a depth of 1000 feet or more to obtain ice cores and to measure the temperature at various depths for study of the earth's climatic history.

The IGY will emphasize upper-air exploration in an effort to increase our knowledge of the top half of our atmosphere. Much of our surface weather and the efficiency of radio communication are affected by variable conditions in this atmospheric ocean.

A year-long "rocket shoot" will pull new plums of knowledge out of the heavens at heights from 60 to 200 miles above the earth. The United States alone plans to launch hundreds of rockets. Several dozen will be 1250 pound, 20-foot Aerobee-Hi rockets, most of them launched at Fort Churchill, Manitoba, on the west coast of Hudson Bay. Others will blast off from New Mexico.

The United States also intends to launch two-stage rockets -- a combination of the Nike booster and the Deacon rocket -- and several hundred smaller rockets. Some will rise from land sites at Thule,

Greenland, and in central Alaska and some from off the coasts of southern California and Virginia. Others will be launched from ships at sea in numerous locations. Rocket-borne cameras and electronic instruments will provide "eye-witness" reports of conditions on the threshold of space.

On July 29, 1955 President Eisenhower announced that the United States planned, as part of its participation in IGY, to launch into space during 1957 or 1958 history's first artificial earth-circling satellite. The first satellite will weigh approximately 20 pounds and will probably be spherical in shape and between 20 and 30 inches in diameter. It will be launched from the Air Force ~~Long-Range Proving Ground~~ Missile Test Center at Cape Canaveral, Florida.

A three-stage rocket will be used to place the satellite in an elliptical orbit about the earth, 200 miles from the earth's surface at the nearest point. The first-stage rocket, providing a thrust of 27,000 pounds, will bring the vehicle to a speed between 3000 and 4000 miles per hour. The first stage will then be left behind as the second stage rocket increases the speed to about 11,000 miles per hour at an altitude of about 130 miles. The vehicle then coasts upward until its path becomes approximately horizontal. At this point the third stage rocket is lit and boosts it to the orbital speed of about 18,000 miles per hour.

The satellite then circles the globe every 90 minutes. It is expected to remain in the orbit for a period from several weeks to

several months depending on the resistance encountered in the rarefied atmosphere which is not accurately known. Ultimately friction will cause the satellite to spiral inward ~~inward~~ and heat up until it burns like a shooting star.

The earth's atmosphere acts like a screen which prevents us from detecting what happens in the upper atmosphere and in nearby outer space. Dr. Kaplan has called the satellite a "long-playing rocket" because it makes possible the type of observations possible only for minutes or seconds from high altitude rockets for periods of weeks or months. These include the determination of outer atmosphere densities by observation of the air drag effect on the satellite orbit, long-term observations of ultraviolet radiation from the sun, fluctuations in intensity of cosmic rays striking the atmosphere from space, and density of hydrogen atoms and ions in interplanetary space.

The governments and institutions of the several nations that pay the total bill of about 250 million dollars for the IGY program expect and will receive very practical dividends in return. They will enjoy improved weather forecasts and radio communication. They will benefit from greater knowledge of the upper air and nearby space in which airplanes, satellites, and eventually space ships will travel. Moreover, there is the possibility of far greater unsuspected discoveries of who-can-guess-what value to man.

The International Geophysical Year will make a significant contribution to man's increasing search for clearer understanding of his surroundings. It will see the first faltering steps toward man's exploration of outer space. It will stir the imagination of countless boys and girls to the wonders and opportunities on the road ahead toward the far horizons of space.

(See "The International Geophysical Year", by Hugh L. Dryden, National Geographic Magazine, February, 1956.)

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